2.3 ERBE-like Monthly Regional Averages (ES-9)

EOSDIS Product Code: CER03

The ERBE-like Monthly Regional Averages (ES-9) product contains a month of space and time averaged Clouds and the Earth's Radiant Energy System (CERES) data for a single scanner instrument. The ES-9 is also produced for combinations of scanner instruments. All instantaneous shortwave and longwave fluxes at the Top-of-the-Atmosphere (TOA) from the CERES ES-8 product for a month are sorted by 2.5-degree spatial regions, by day number, and by the local hour of observation. The mean of the instantaneous fluxes for a given region-day-hour bin is determined and recorded on the ES-9 along with other flux statistics and scene information. For each region, the daily average flux is estimated from an algorithm that uses the available hourly data, scene identification data, and diurnal models. This algorithm is "like" the algorithm used for the Earth Radiation Budget Experiment (ERBE). The ES-9 also contains hourly average fluxes for the month and an overall monthly average for each region. These average fluxes are given for both clear-sky and total-sky scenes.

The ES-9 archival data product is created as an HDF file with six Vgroups and contains data for each 2.5-degree region observed during a month. There are 10,368 regions in the ERBE-Like data; therefore, there is a maximum of 10,368 records in the ES-9 data set. A summary of the contents of this data product can be found in Table 2.3-1. The ES-9 product size shown in this table assumes that all 2.5-degree regions and all hourboxes contain data. Since the hourboxes are sparsely populated, sizing estimates per platform are 95 MB (TRMM), 260 MB (Terra), and 260 MB (Aqua). The sizing estimate for the ES-9 in the "Archival Products Summary" table is for Aqua. A more detailed listing of the data parameters for this product can be found in the ES-9 Collection Guide: http://asd-www.larc.nasa.gov/ceres/collect_guide/list.html (Reference 3).

Level: 3
Frequency: 1/Month
Portion of Atmosphere Covered: TOA

Time Interval Covered:
- **File:** 1 Month
- **Record:** Hourbox Data

Portion of Global Covered:
- **File:** Global
- **Record**: Regional

Product Version:
- **TRMM:** Edition1, Edition2
- **Terra:** Edition1, Edition2
- **Aqua:** Edition1, Edition2

ES-9 Metadata

The content of the ES-9 is summarized in Table 2.3-1. The metadata structures contain information which need only be recorded once per monthly product. The CERES Metadata are listed in Appendix B. The ES-9 Product-specific Metadata are shown in Table 2.3-2.

Table 2.3-1. ES-9 Product Summary

HDF Name	Description	Records	Number of Fields	Nominal Size (MB)
CERES Baseline Header Metadata	See Table B-1	1	35	
CERES_metadata Vdata	See Table B-2	1	14	
ES-9 Product Specific Metadata	See Table 2.3-2	1	1	
ES-9 Vgroup Summary	See Table 2.3-3	1	6	1099.115
ES-9 TOTAL SIZE (MB/Month)				**1099.115**

Table 2.3-2. ES-9 Product Specific Metadata

Item	Parameter Name	Records	Units	Range	Data Type
1	ES9BinaryProductionDate	1	N/A	N/A	ASCII string

ES-9 Scientific Data Sets

The ES-9 contains science parameters written as HDF Scientific Data Sets (SDSs) which are 1- or 2-dimensional arrays of spatially ordered records that are organized by Vgroups. An overview of each of these Vgroups is given in Table 2.3-3. Detailed definitions of each parameter on the ES-9 may be found in the ES-9 Collection Guide (Reference 3).

Table 2.3-3. ES-9 Vgroup Summary

Vgroup Number	Vgroup Name	Description	Number of Records	Maximum SDS Size (MB)
1	Regional Summary Data	See Table 2.3-4	$10368^{a} \times 10^{b}$	0.396
2	Monthly (Day) Averages	See Table 2.3-5	$10368^{a} \times 28^{b}$	1.107
3	Monthly (Hour) Averages	See Table 2.3-5	$10368^{a} \times 28^{b}$	1.107
4	Daily Averages	See Table 2.3-5	$10368^{a} \times 31 \times 28^{b}$	34.330
5	Monthly Hourly Averages	See Table 2.3-5	$10368^{a} \times 24 \times 34^{b}$	32.273
6	Hourbox Data	See Table 2.3-6	$(10368 \times 744)^{c} \times 34^{b}$	1029.902
Total SDS size (MB)				**1,099.115**

a. The first dimension of the SDS will equal the number of 2.5-degree regions contained on the ES-9.
b. This dimension represents the number of SDS parameters contained in the Vgroup.

c. The first dimension of this SDS is equal to the sum of the number of hourboxes per region over all the regions actually contained on this ES-9, or it is equal to the sum of all "Number of hourboxes" from the Regional Summary Data Vgroup. 10,368 is the maximum number of 2.5-degree regions, and 744 is the maximum number of hourboxes per region, so the maximum size of the first dimension for this SDS is 10,368 x 744 = 7,713,792.

Table 2.3-4 lists the SDSs contained in the Regional Summary Data Vgroup.

Table 2.3-4. Regional Summary Data

Parameter Name
See Table 5-4 in ES-9 Collection Guide
Region number
Longitude
Colatitude
Geographic scene type
Scene fraction histogram (1)
Scene fraction histogram (2)
Scene fraction histogram (3)
Scene fraction histogram (4)
Number of hourboxes
Start position of hourbox data

Table 2.3-5 lists the SDSs contained in the Temporal Vgroups for each 2.5-deg region

Table 2.3-5. Temporal Vgroups for 2.5-deg Regions (1 of 2)

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in ES-9 Collection Guide	5-5	5-6	5-7	5-8	5-9	5-10	5-11	5-12
Region number	X	X	X	X	X	X	X	X
Solar constant, distance corrected					X	X		
Solar incidence	X	X	X	X	X	X	X	X
Net radiant flux	X	X	X	X				
Longwave flux	X	X	X	X	X	X	X	X
Longwave flux minimum value	X	X	X	X	X	X	X	X
Longwave flux maximum value	X	X	X	X	X	X	X	X
Longwave flux standard deviation	X	X	X	X	X	X	X	X
Number of hours of longwave flux			X	X	X	X		
Number of days of longwave flux	X	X					X	X
Longwave sum of estimates							X	X
Longwave sum of estimates squared							X	X
Shortwave flux	X	X	X	X	X	X	X	X
Shortwave flux minimum value	X	X	X	X	X	X	X	X

Table 2.3-5. Temporal Vgroups for 2.5-deg Regions (2 of 2)

Parameter Name	Temporal Vgroups							
	Monthly (Day) Averages		Monthly (Hour) Averages		Daily Averages		Monthly Hourly Averages	
Sky (Cloud Cover) Vgroup	Total	Clear	Total	Clear	Total	Clear	Total	Clear
Table in ES-9 Collection Guide	5-5	5-6	5-7	5-8	5-9	5-10	5-11	5-12
Shortwave flux maximum value	X	X	X	X	X	X	X	X
Shortwave flux standard deviation	X	X	X	X	X	X	X	X
Number of hours of shortwave flux			X	X	X	X		
Number of days of shortwave flux	X	X					X	X
Shortwave sum of estimates							X	X
Shortwave sum of estimates squared							X	X
Albedo	X	X	X	X	X	X	X	X

Table 2.3-6 lists the SDSs contained in the Hourbox Data Vgroup.

Table 2.3-6. Hourbox Data

Parameter Name	Parameter Name
See Table 5-13 in ES-9 Collection Guide	
Region number	Longwave flux minimum value
Number of hourboxes	Longwave flux maximum value
Hourbox number	Longwave flux standard deviation
Time of observation	Number of longwave flux estimates
Scene fraction (1)	Longwave flux maximum difference
Scene fraction (2)	Shortwave flux
Scene fraction (3)	Shortwave flux minimum value
Scene fraction (4)	Shortwave flux maximum value
Albedo factor (1)	Shortwave flux standard deviation
Albedo factor (2)	Number of shortwave flux estimates
Albedo factor (3)	Shortwave flux maximum difference
Albedo factor (4)	Clear-sky longwave flux
Cosine of the solar zenith angle	Clear-sky longwave flux standard deviation
Satellite zenith angle	Number of clear-sky longwave flux estimates
Azimuth angle	Clear-sky albedo standard deviation
Solar incidence	Longitude
Longwave flux	Colatitude

ES-9 Revision Record

The product Revision Record contains information pertaining to approved section changes. The table lists the date the Software Configuration Change Request (SCCR) was approved, the Release and Version Number, the SCCR number, a short description of the revision, and the revised sections. The authors are listed on the document cover.

ES-9 Revision Record

SCCR Approval Date	Release/ Version Number	SCCR Number	Description of Revision	Section(s) Affected
N/A	R3V1	N/A	• Updated format to comply with standards.	All
2/23/04	R4V1	503	• Updated product versions for Aqua Edition1 to include Edition2. • Updated format to comply with standards.	All All